POTTER **RAM**®

PRODUCT DATA
1-103

TLM–4550
DUAL CARTRIDGE RANDOM ACCESS MEMORY

POTTER INSTRUMENT CO., INC.®

FOR THE FIRST TIME A RANDOM ACCESS MEMORY USING MAGNETIC TAPE

- Fastest Operation Available
- Automatic Cartridge Loading
- Unique Check-Read-After-Write Capability
- Non-Contact Recording
- Linear Head Positioning
- Extreme Dependability
- Simple Servicing

Figure 1. The Potter RAM, Model TLM-4550. Shown with Model ACC-8601 Tape Pack Cartridge

Figure 2. RAM Tape Pack Cartridge, Model ACC-8601

TAPE PACK FEATURES

- High Capacity — Over 50 Million Bits
- Low Price — Lowest Available
- Complete Data Security
- Interchangeable Cartridges
- Rugged Strength, Sealed Enclosure
- Lightweight — Readily Stacked
- Replaceable Low-Cost Storage Element

Effective: April 15, 1966

AUTOMATIC CARTRIDGE LOADING — *Approximately 15 Seconds!*

Operator Selects Tape Pack Cartridge.

Places Cartridge on Loading Carriage.

Presses "LOAD" Pushbutton. Fully Automatic Startup.

Figure 3. Cartridge loading is as simple for the operator as it is possible to make it. A cartridge is placed on the machine carriage; a latch snaps it secure. From this point everything is automatic. The operator simply presses the "LOAD" pushbutton and walks away, leaving the machine to load the cartridge, start up automatically, and signal the "ready" condition, all within a few seconds. Both cartridges are driven simultaneously and cartridges may be interchanged from one side of the machine to the other, a file of several cartridges, or between machines.

DRAMATIC STEP FORWARD IN PERFORMANCE CHARACTERISTICS!

Unlike any other machine in its class, the RAM can check-read data immediately after writing. This makes a dramatic difference in the performance characteristic. While other machines are occupied with the extra revolution of the recording medium, necessary to check-read, the RAM has already started the next access. Data throughput rates are enormously improved, and there is no need for the special data sequencing which attempts to minimize latency effects.

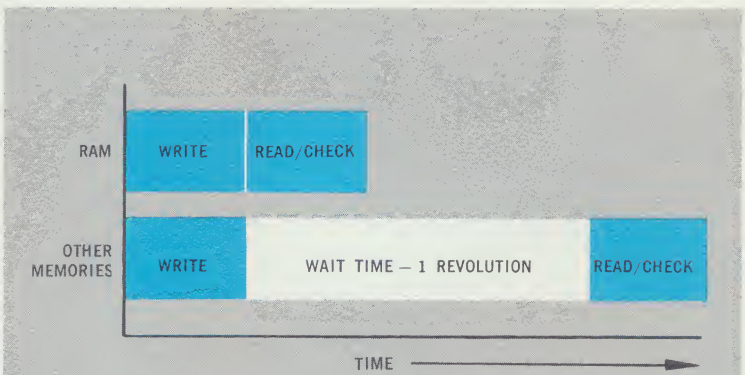

Figure 4. Comparison of RAM vs Competing Machines in Typical Operation

The remarkable characteristics of the RAM concept provide advanced performance plus simplified machine design, high reliability and lowest cost per bit stored. This is truly a breakthrough in design approach.

Comparisons between the RAM and other machines show typical operations being accomplished in half the usual time, with cartridge capacity doubled and cost per bit stored reduced to one quarter. In addition, vulnerable recording discs have been replaced by highly shock resistant magnetic tape sealed in rugged Tape Pack cartridges.

The Potter RAM is a cartridge loaded random access system for use with medium and low cost digital computer systems. Typical applications are: inventory control, computer programming, real-time data processing, and mathematical and scientific analyses . . . wherever rapid access to a volume of information is required, and where the information is too large to be economically accommodated by ferrite core memory systems.

Information is recorded serially in a multiplicity of tracks on loops of tape, and any information may be written or read at random by transmitting address information to the unit together with an appropriate command signal.

All channels have equal storage capacity and equal bit packing density. Thus, "zoned" arrangements of information, as used with disc memories to achieve reasonable storage efficiency, are not required.

The dual-cartridge RAM offers the same on-line capacity and performance capabilities intrinsic in the single-cartridge model, but offers additional operational flexibility. The dual-cartridge RAM is capable of copying partial or entire data content from one cartridge to the other, eliminating the need for two machines where the on- line capacity of one machine is adequate.

UNIQUE TAPE PACK CARTRIDGE

The Model TLM-4550 accepts two Potter Model ACC-8601 Tape Pack Cartridges, each of which has a storage capacity of 25.1 million bits of information. The tape loop assembly is totally enclosed within a dust-tight, rigid, aluminum case. An aluminum-on-plastic tambour door on the end of the cartridge case provides passage for the drive mechanism when in use.

The complete cartridge assembly is highly resistant to rough handling. The rectangular form, convenience of handling, and light weight of the cartridge permits stacked storage in minimum space and very easy handling. The absence of close tolerance internal fittings avoid misalignment by careless handling, and the tape loops are inherently not subject to deformation and damage by shock and vibration.

Non-contact Potter high density recording is used in a "write broad-read-narrow" single track configuration. No permanent errors occur and the probability of transient errors is so low as to be a negligible factor.

Figure 5. Potter Tape Pack, Model ACC-8601, Magnetic Tape Loop Configuration

PRINCIPLES OF OPERATION

THE DRIVE SYSTEM

The loops of high quality digital magnetic recording tape in the cartridge each have an associated drive unit on the machine. Figure 6 shows the position of the tape loop which clears the drive assembly and the head as the cartridge is loaded, with the capstan stationary. When the tape loops are positioned, vacuum is applied to the buffer chamber above the capstan, deflecting the tape so that its backing surface makes a non-slipping contact with the surface of the capstan, which is now rotating. The tape loop is now in the driving condition as shown in Figure 7.

Of special importance is the fact that the tape flies over the write-read head, maintaining a precise and stable gap between the oxide recording surface and the head profile.

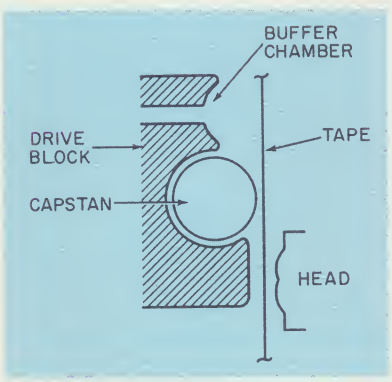

Figure 6. Position of Tape Loop As Cartridge Is Loaded

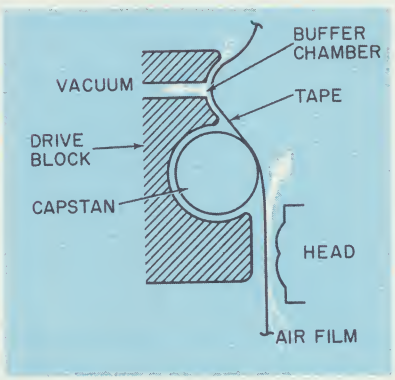

Figure 7. Tape Loop in Driving Condition

Figure 8. The Tape Loop is Entirely Supported on An Air Cushion While in Motion

PRINCIPLES OF OPERATION *continued*

Figure 8 shows, diagrammatically, the fixed air bearings which control the tape loop, at top and bottom. These fixed elements conduct air under pressure to the bearing surfaces which forms a supporting film. Thus the tape loop is entirely supported on an air cushion while it is in motion.

MULTIPLE DRIVE BLOCKS

The individual drive blocks are arranged in two compact groups on the faceplate of the machine, with a common capstan serving each group. (Figure 9). A common vacuum supply is connected to all of the buffer chambers so that all loops are engaged in the driving position simultaneously, as part of the automatic load cycle. The twin capstans run in specially designed long-life bearings. Figure 10 shows the appearance of the drive assembly with one group of drive blocks removed to provide access to the head post. The vacuum and pressure porting can be seen and also the location of the capstan threading the remaining group of drive blocks. There are sixteen drive block sections in all, providing a 16 loop drive.

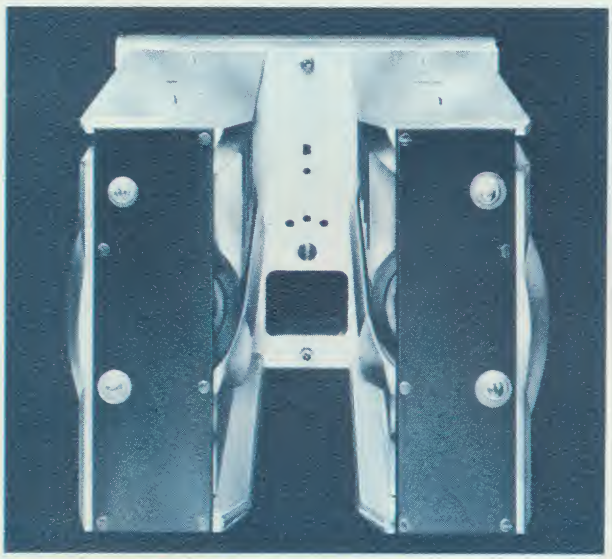

Figure 9. Multiple Drive Block Assembly

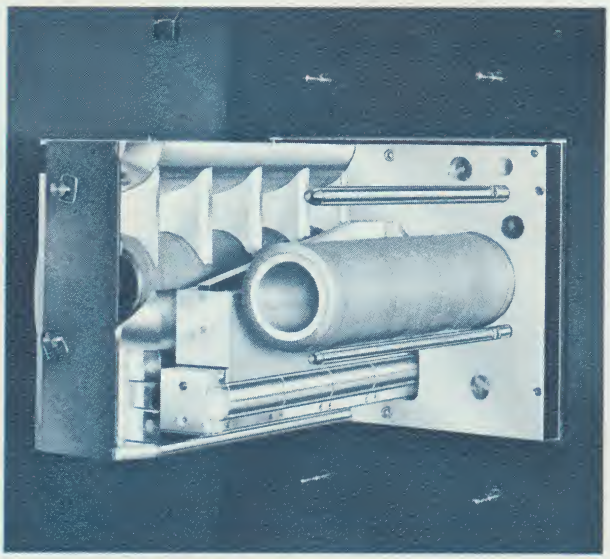

Figure 10. Multiple Drive Block Assembly with One Group of Drive Blocks Removed

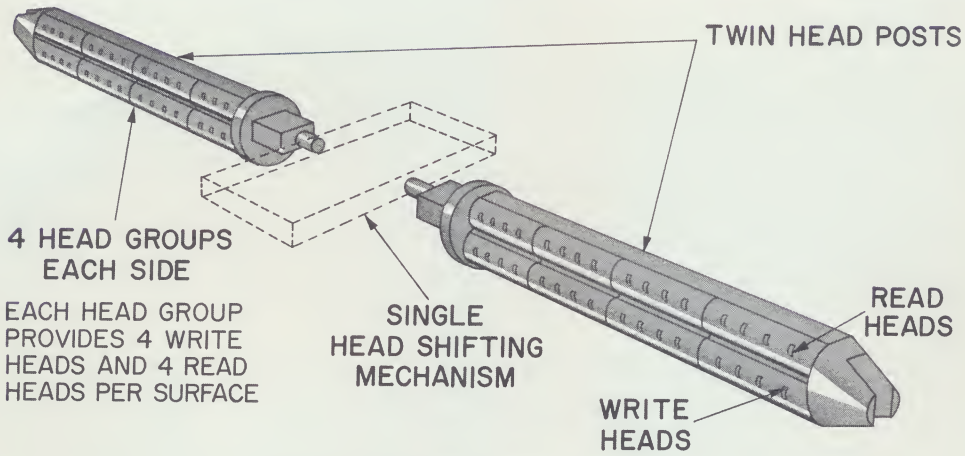

Figure 11. Write/Read Head Post

HEAD POST ASSEMBLY

All of the write/read heads are mounted in a common head post located between the two rows of tape loops in each group. The position of the head post can be seen in Figure 10. The general arrangement of the head post itself is as shown in Figure 11. The lower row of heads provides the writing function and the upper row the reading function. The heads are arranged in sections so that four writing and four reading heads are presented to each of the recording surfaces. A similar arrangement prevails on the other side of each head post to furnish reading and writing functions for the alternate group of loops.

The profile of the head post is contoured with a smooth surface finish to define the desired stable flying attitude for the tape. The head post forms a rigid beam structure which permits the heads to be traversed over the recording surfaces under the control of the head post positioning mechanism. Both head posts move simultaneously under the control of a single positioning mechanism.

HEAD POSITIONING MECHANISM

Because the head positioning system demands only a linear movement of a single assembly over a very short distance, a simple mechanism is possible. This takes the form of a binary input positioning linkage sometimes referred to as a "whiffletree." A diagrammatic representation of the head positioning mechanism showing linkage relationships is given in Figure 12. Five equal amplitude input deflections acquire binary weightings of $2^0 - 2^4$ and from the linkage relationships provide 32 precisely repeatable positions of the head post with very fast head shifting. Of these 32 positions 28 are actually required for positioning the head; the remaining four are electronically ignored by the equipment. The actual head positioning mechanism is shown in Figure 13.

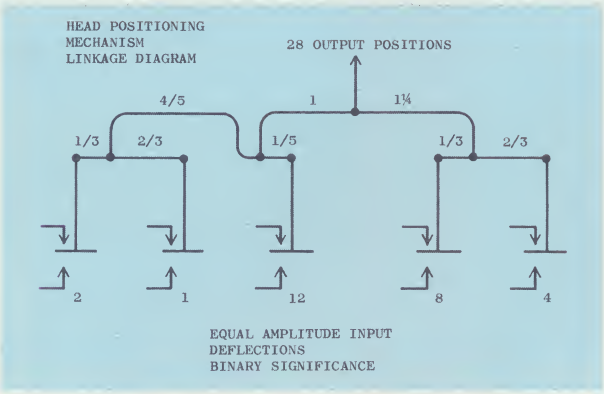

Figure 12. Diagrammatic Representation of Head Positioning Mechanism Showing Linkage Relationships

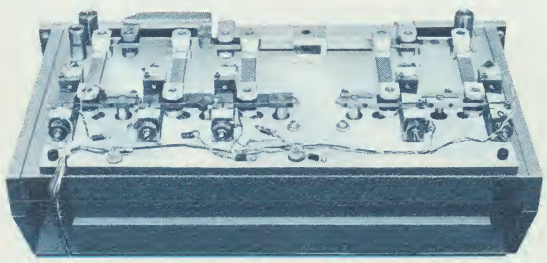

Figure 13. Head Positioning Mechanism

PERFORMANCE CHARACTERISTICS

The average access time to any stored record at random is made up of the average head positioning time plus an average latency time of one half revolution of the recording medium.

Check reading is performed immediately after writing. It is not necessary for the recording medium to make an extra revolution to check read, as required in other random access devices.

This is illustrated by the characteristic shown in Figure 14. At point A the first access to a record has been achieved in time T_1. Normally the time T_2 would elapse before check reading could be carried out at point B.′ The characteristic RAM operation follows line AB, check reading at B still being achieved in time T_1 plus the very small increment of time which elapses due to gap spacing. The elimination of wait time for check reading results in higher processing rates.

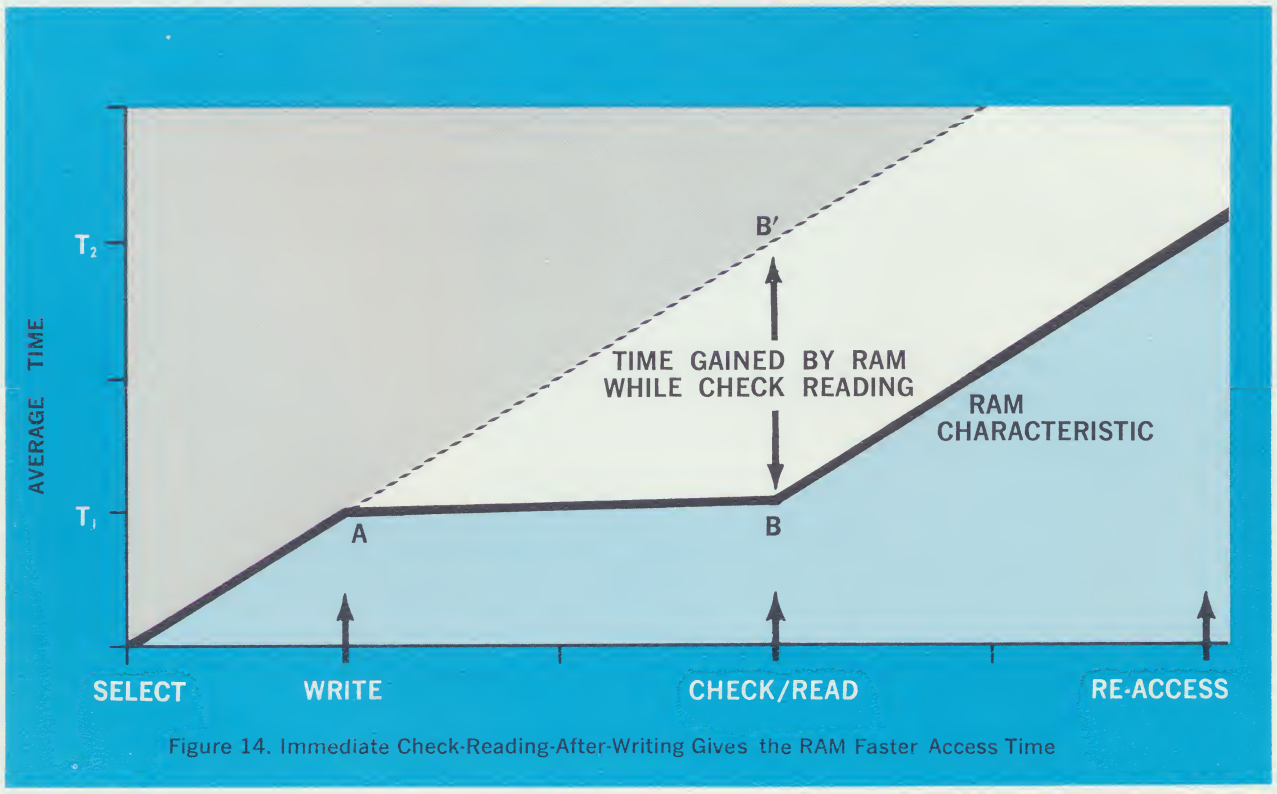

Figure 14. Immediate Check-Reading-After-Writing Gives the RAM Faster Access Time

PERFORMANCE CHARACTERISTICS

continued

DATA SECURITY

As the design approach of the RAM is reviewed feature by feature, it becomes obvious that a vital supplement to the higher performance/price ratio is the new order of data security that is realized. The use of a flexible recording medium eliminates machine damage and information loss resulting from head and disk crashes encountered in other random access memories. The sealed cartridges do not require the rigorous and elaborate machine room procedures which are essential to establish confidence in disk cartridge storage.

Spare tracks on the recording surfaces are unnecessary. Under normal conditions, the tape loops are practically indestructible and it is possible to recover data even in the extreme case of catastrophic damage to a cartridge housing.

SIMPLE MAINTENANCE

The maintenance required to insure reliability is reduced to a minimum and made exceptionally convenient and quick. After sliding back the transparent machine cover, drive blocks can be removed from their mountings after unfastening only two captive screws. This exposes the head post completely in a few seconds. The conveniently laid out components are all easily accessible in the frame assembly of the unit, which has removable cover panels.

EQUIPMENT

The complete Model TLM-4550 RAM System comprises:

1 — Free-standing cabinet of welded box frame construction with removable cover panels
2 — Faceplates, each with two drive block assemblies and twin loop drive capstans
2 — Read/Write head post assemblies, each with eight Read / Write head modules, each module containing four tracks
2 — Cartridge loading assemblies with motor drive
1 — Head positioning mechanism
1 — Capstan drive system

Logic level interface electronics, including Write amplifier, Read amplifier, track addressing system, with address register and associated power supply.

All local controls, interlocks and auxiliary equipment associated with machine functions, including automatic load cycle control, air pressure and vacuum generators.

The equipment is furnished complete with all controls, indicators and internal wiring and ready for interconnection and operation with a suitable control unit.

TAPE PACK CARTRIDGE

Tape Pack cartridges may be supplied on special order to cover a range of storage capabilities. RAM Model TLM-4550 accepts Model ACC-8601 Tape Pack Cartridges which contain 8 tape loops, each 30 inches in length and 2 inches in width. Storage capacity of the ACC-8601 cartridge is in excess of 25.1 million bits. All channels have equal storage capacity and equal bit packing density.

Complete specification for the TLM-4550 and ACC-8601 Tape Pack are given on the following page. For further information, write, wire or call: General Sales Manager, Potter Instrument Company, Inc., 151 Sunnyside Boulevard, Plainview, New York (11803). Telephone: 516 OVerbrook 1-3200. TWX: 510-221-1852. Cable: PICO.

SPECIFICATIONS

I. EQUIPMENT SPECIFICATIONS

MEMORY	Flexible tape loop memory using dual, interchangeable cartridges
METHOD OF RECORDING	Non-contact recording using serial format in multiple unrelated tracks. Potter high-density Write broad/Read narrow configuration

STORAGE CAPACITY

ON-LINE STORAGE CAPACITY	50.2 million bits
CARTRIDGE CAPACITY	25.1 million bits
TOTAL CYLINDER CAPACITY (without head movement)	1,792,000 bits
SINGLE LOOP CYLINDER CAPACITY (without head movement)	112,000 bits
INFORMATION PER TAPE LOOP	3.1 million bits
INFORMATION PER TRACK	28,000 bits

CARTRIDGE CONFIGURATION

NUMBER OF TRACKS PER TAPE LOOP	112
INFORMATION PACKING DENSITY	1020 bits/inch
CIRCUMFERENCE OF TAPE LOOP	29.76 inches
RECORDING LENGTH OF TAPE LOOP	27.72 inches
TAPE WIDTH	2 inches
NUMBER OF LOOPS PER CARTRIDGE	8
NUMBER OF CARTRIDGES PER RAM	2

HEAD CONFIGURATION

Separate Read and Write heads permit immediate check-reading-after-writing.

OPERATION TIMES

AVERAGE ACCESS TIME (Random Mode)	96 ms
AVERAGE HEAD POSITIONING TIME	71 ms
MAXIMUM HEAD POSITIONING TIME	85.0 ms
MINIMUM HEAD POSITIONING TIME	45.0 ms
AVERAGE LATENCY TIME	25.0 ms
FULL REVOLUTION TIME	50.0 ms
CHECK-READ LATENCY TIME	0.425 ms
DATA TRANSFER RATE	600 kc/sec
TAPE SPEED	588 inches/sec
INPUT VOLTAGE	117V or 234V ±10%, 50/60 cps ±.15%
POWER	3KVA maximum

DIMENSIONS

CARTRIDGE, ACC-8601 (8 loops, 25.1 million bits of on-line capacity)	12⅛" W x 18" H x 12" D
RAM, TLM-4550 (16 loops, 50.2 million bits of on-line capacity)	46" W x 50" H x 25⅞" D
WEIGHT, APPROXIMATELY (RAM)	1000 lbs.
WEIGHT, APPROXIMATELY (CARTRIDGE)	12 lbs.

II. ENVIRONMENTAL SPECIFICATIONS

OPERATING

TEMPERATURE RANGE	40°F to 100°F (5°C to 38°C)
HUMIDITY RANGE	30% RH to 90% RH, no condensation

STORAGE AND TRANSIT (Equipment and Cartridge)

TEMPERATURE RANGE	−20°F to +140°F (−30°C to +60°C)
HUMIDITY RANGE	Up to 98% RH, no condensation

III. MODES OF OPERATION AND CONTROL SIGNALS

SIGNALS TO UNIT

TRACK LOCATE (16 loop system)	parallel input comprising 11 binary bits
WRITE ENABLE	Control Signal (level)
DATA INPUT	Serially at selected frequency

SIGNALS FROM UNIT

EQUIPMENT READY	DC level = 6 volts in ready condition

About POTTER®

POTTER WORLDWIDE FIELD SERVICE AND LOGISTICS PROGRAM — Repair centers in strategic locations within the continental United States and abroad have been established to support the entire Potter product line.

Staffed by highly-trained field representatives, these repair centers are equipped to effect on-site installation of equipments and to perform quality repair, maintenance and overhaul.

Supplementing this capability, if a customer prefers to provide his own equipment support, Potter has established standard instruction courses to train customer personnel, either at Potter or in the field.

A Spare Parts Department, backed up by an extremely large inventory and streamlined order processing, is available for customer convenience and economy. This inventory permits the customer to realize virtual elimination of downtime as well as savings on spare parts dollars by offering expeditious delivery for replaceable parts. Delivery is available in 24 hours to meet customer emergency requirements—within 72 hours for standard parts under normal conditions. Potter also offers provisioning and logistics capabilities to meet all existing military specifications.

The Potter field service and logistics program is one of the finest in the EDP equipment industry. With reliable, quality-engineered equipment, supported by comprehensive field service, Potter guarantees satisfaction.

POTTER PLANTS — Tape transport production is carried on in this modern 62,000 sq. ft. plant on Sunnyside Boulevard, Plainview, New York. Building also houses corporate offices, sales, engineering and research groups.

East Bethpage Road plant (below), completed in 1963, produces high-speed printers. A third plant in Luquillo, Puerto Rico, manufactures magnetic and photoelectric recording and playback heads. Total manufacturing space in all Potter plants exceeds 110,000 sq. ft.

Present Potter employment is in excess of 650 people.

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